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New Approaches to Spray Disinfectants to Fight Coronavirus

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ABSTRACT

Our world is facing an unprecedented public health and economic crisis due to COVID-19. In this toughest challenging time, we are proposing some effective & affordable techniques for spraying disinfectants on each house, streets and roads of nation to help humanity to cope up with this calamity. We propose new spraying techniques and different type of disinfectants to disinfect larger areas repeatedly using two wheelers and other automobiles where larger vehicles can't access and disinfect routinely. This will be effective in current as well as post lockdown pandemic era because very large population is involved in this movement and common public areas will be disinfected repeatedly and regularly without energy consumption.

Keywords: Disinfectants, exhaust, vehicles.

1 Introduction

In humans, coronaviruses are known to cause respiratory infections like Middle East Respiratory Syndrome (MERS), Severe Acute Respiratory Syndrome (SARS) and CoVID-19. Testing and quarantine actions are being taken at large scale by governments & private sectors. Lockdowns are temporary measure and long-term arrangements are needed to overall hygiene to prevent spread of all infectious diseases especially COVid-19. There are lot of disinfectant spraying techniques are practiced throughout the world based on WHO's recommendations (1). Adequate manpower is required to spray disinfectants to delink the chain of COVID19 spread. Currently sanitation workers alone battling against this spread which require a public support. In this proposal we are focusing on various techniques of disinfectant spraying methods and engaging public which are simple and affordable methods during lockdown & post lockdown pandemic era. Here we are discussing about how to disinfect homes, larger areas routinely using two wheelers and smaller automobiles, where larger vehicles can't access and disinfect daily.

2 Materials and disinfectants

2.1 Materials

Material required are plastic or PET bottles, garden water cans, vehicle tyre tubes, clamps/ holders & liquid disinfectant. Solution valve assembly, cap, gasket, ball valve, suction valve housing, Trigger cut – off valve, flat fan Nozzle, handle, spring, pump barrel bucket (2), bucket assembly, foot rest, mini gears, strips, vegetable oils, foams, exhaust or any other containers filled with chemical disinfectants.

2.2 Disinfectants & its mode of application

2.2.1 Disinfectants

- Sodium hypochlorite, (EPA registration number – 56392-10, 67619-17, 67619-30, 67619-32) is reported as effective disinfectant (EPA 2020) (3), sodium hypochlorite (1-10%) concentration is effective against bacteria, viruses and fungi. The high pH of sodium hypochlorite interferes with the cytoplasmic membrane integrity, causing an irreversible enzymatic inhibition, biosynthetic alterations in cellular metabolism and phospholipid degradation by lipidic peroxidation (4). Available commercial products are Clorox & Sodium Hypochlorite 8.25% etc.
- Alcohol, (EPA registration number (42964-17, 62472-2) (EPA 2020) (5), work through the disruption of cellular membranes, solubilisation of lipids, and denaturation of proteins by acting directly on S-H functional groups. Ethyl and isopropyl alcohols are the two most widely used alcohols for their biocidal activity. These alcohols (70%) concentration are effective against lipid-containing viruses and a broad spectrum of bacterial species.
- Quaternary ammonium compounds. (EPA registration number 675-54, 6836-70, 6836-75, 6836-77(EPA 2020) (6), are generally fungicidal, bactericidal, and virucidal against lipophilic (enveloped) viruses. Available commercial products are - Maquat 256-MN, Maquat 128-MN, Maquat 64-MN, Maquat 32-MNL, Lysol, Lonza & Sterilex Ultra etc.
- Phenolics, (EPA registration number 3862-179), are phenol (carbolic acid) derivatives. These biocides (1-2%) concentration act through membrane damage and are effective against enveloped viruses, fungi and vegetative bacteria. They also retain more activity in the presence of organic materials than other disinfectants. Available commercial products are - Cresols, hexachlorophene, alkyl- and chloro derivatives and diphenyls are more active than phenol itself (7,8,9).
- Hydrogen peroxide (3%), EPA registration number (66171-103, 45745-11, 65402-9) (EPA 2020) (10). It can be used as is, or diluted to 0.5% concentration for effective use against coronaviruses on surfaces. Available commercial products are- VigorOx 15/10 & Peroxy HDOX, etc.
- Natural disinfectants: A study on influenza viruses found that cleaning with a 10% solution of malt vinegar was found effective (11).

2.2.2 Mode of application of disinfectants

This article summarizes various techniques to apply disinfectants on large common public areas such as roads, parks, etc., both for liquid and solid disinfectants. With recommended concentration liquid disinfectants can be utilize in spray mode by moving vehicles with piston pump and dripping assembly. With recommended concentration solid disinfectants can be utilized by spreaders using two wheelers and small automobiles from Pouches (fig 1).

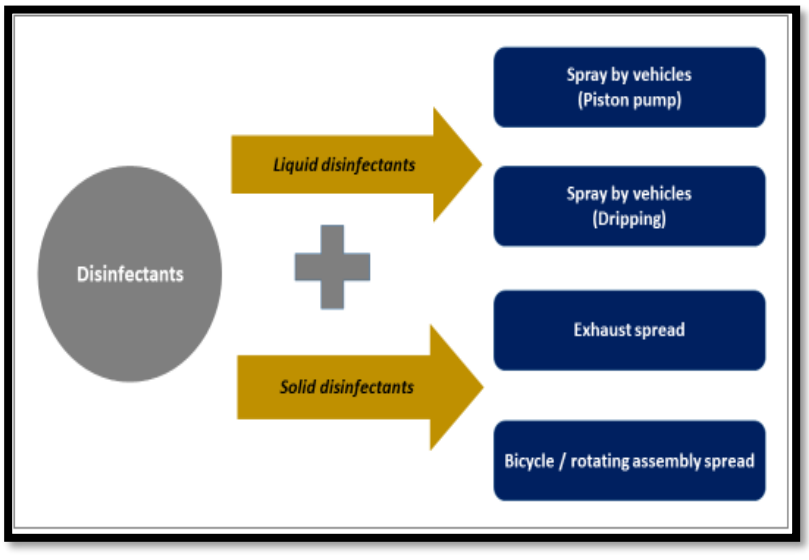

Figure No. 1 disinfectants & mode of applications

Like sodium hypochlorite (12), isopropanol, and ethanol (13) with appropriate concentration can be sprayed in liquid form.

3 Available spraying methods & limitations

To disinfect roads sodium hypochlorite are widely used by various organisations and governments which are recommended by WHO. Tankers/ trucks / drones / tunnels are used as a disinfectant carrier unit to spray at required area. These techniques are effective in current situations to fight against coronavirus with some limitations. Limitations are reaching specific area periodically, man power requirement, electrical, fuel consumption and cost (14,15).

Innovative concept systems which designed in this write-up are automated, runs with running vehicle/ exhaust, without extra power consumption, man power, and big machineries/ set up. Easy to operate, portable, less maintenance & low cost. Spraying disinfectants through these techniques is equivalent to number of moving vehicles/ exhaust fans. Less quantity of disinfectants can be utilized for larger area, and small street or lane can be covered, where big machineries are not accessible.

4 Promising approaches to disinfect coronavirus

4.1 Liquid disinfectants

As shown in the figure (2a, b), disinfectants filled assembly can be fixed with two-wheeler or automobile to spray a fine mist on roads or streets.

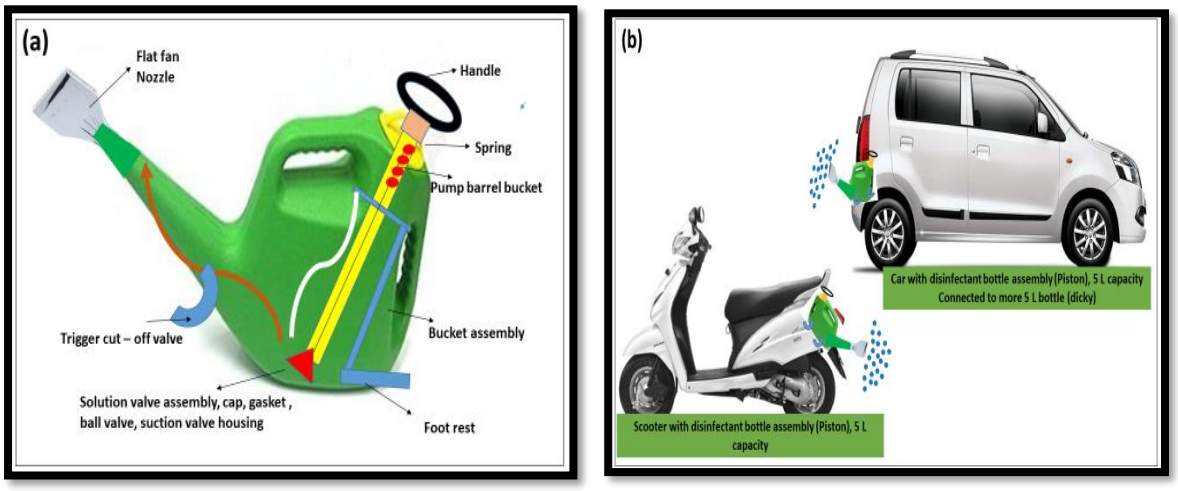

Figure No. 2 Water bottle disinfectant spray by vehicles (piston pump)
a) Disinfectant water bottle with piston pump assembly & **b)** sprinkling disinfectant by vehicle

Similarly, disinfectant container fixed with fan (fig3. a), can be used to sprinkle the liquid disinfectant effectively during motion of the vehicle (fig3. b).

4.2 Disinfectant spray by vehicles (dripping)

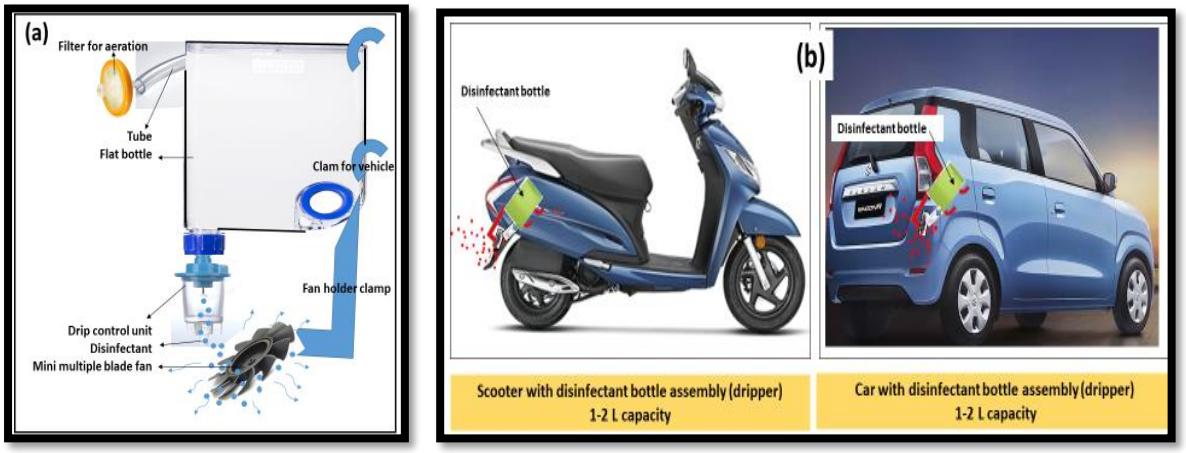

Figure No. 3: Water bottle disinfectant spray by vehicles (dripping);
a) Disinfectant water bottle with dripping assembly & **b)** sprinkling of disinfectant by vehicle.

Advantages of this method is larger population can be engaged during their regular commute which helps to disinfect common area repeatedly and regularly without energy consumption.

4.3 Solid disinfectants

4.3.1 Disinfectant spread by exhaust (porous pouches)

Natural or synthetic disinfectants can be mixed with solidifier to make a solid bar and packed in a porous pouch. This solid bar disinfectant can be placed in exhaust units of home, hospitals and office.

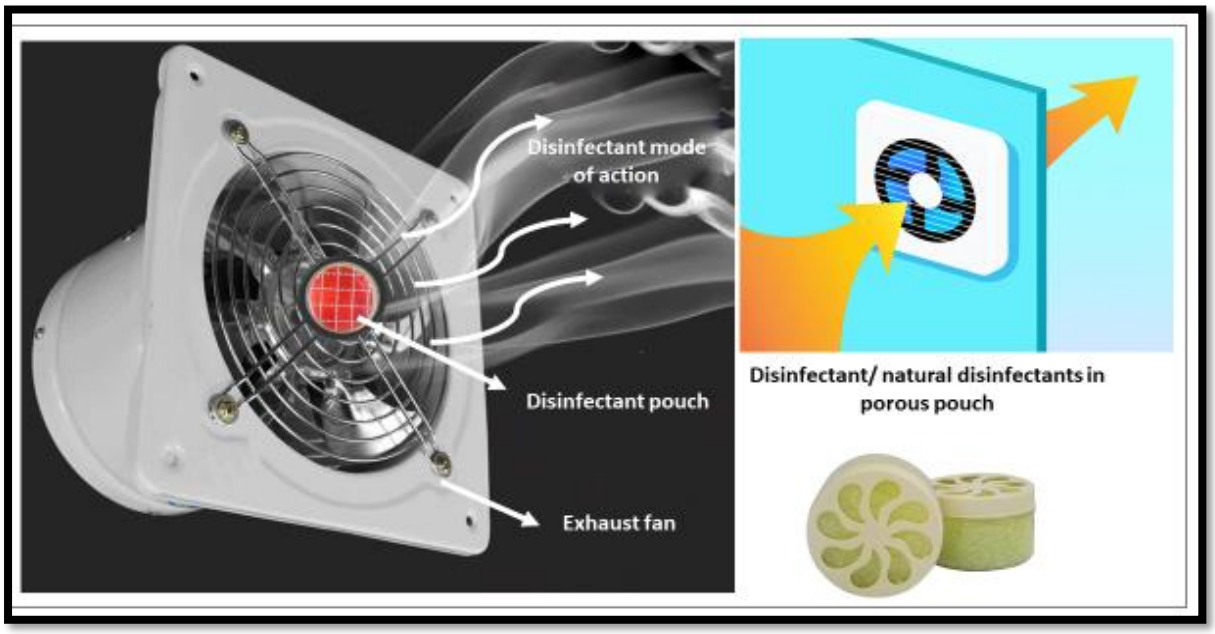

Figure No.4: Disinfectant spread by exhaust (porous pouches)

This strategy helps to prevent spreading of infectious germs in the surrounding environment. These pouches can be installed (fig 4) on exhaust fan or even on moving vehicles, home décor items, wind chains, washrooms and entrance of door as well.

4.3.2 Disinfectant spread by rotating models

Disinfectant pouches can be attached to the spokes of bicycle as shown in (fig5. a) or mudguard front / side deck of 2-wheeler (fig5. b), and disinfectants will spread when the wheel rotates.

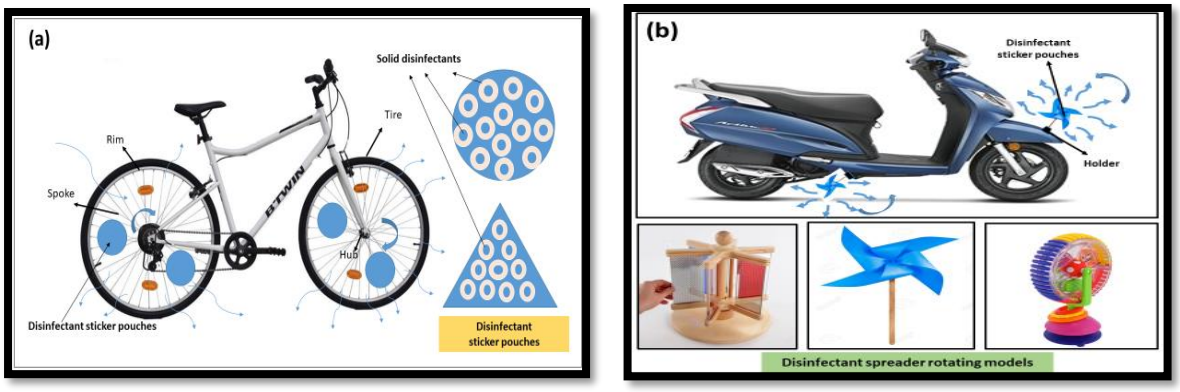

Figure No.5: Disinfectant spread by rotating models
(a) Disinfectant pouch on bicycle spoke & **(b)** Disinfectant pouch rotating on scooter.

This model is effective, easy to operate & can be utilized to spread disinfectants on small roads not easily accessible by automobiles, especially in poor neighbourhoods.

5 Production and Regulation

This "QUIT CORONA" movement requires a financial and administrative support from public and government. Sponsors would be philanthropist or civic bodies like municipalities, government authorities, legislative members, housing societies, private companies and NGOs. Prototype production can be managed from plastic manufacturers, automobile industries and other small-scale industries. Distribution of disinfectants can be done through housing societies, malls, toll plaza, petrol bunks, entrances of any organisations. It is mandatory to draft a comprehensive policy or guideline for its implementation & regulation of chemical dosage. Guidelines will be helpful for maximum utilization of disinfectants effects in minimum quantity & prevention of its hazardous effects for mankind.

6 Conclusion

These new spraying disinfectants techniques could be effective, easy to operate, affordable, portable and accessible to each part of nation, the streets and roads where big machineries are not able to reach. Spraying mist can reduce the usage of disinfectants dosage and more effective by occupying large surface are in minimum disinfectants quantity. Solid disinfectants kept in exhaust or automobiles will be helpful to reduce contaminants in surrounding area. These techniques are economically feasible because no excess energy and man power is required. These techniques will be effective in the current as well as post lockdown pandemic era, as a social responsibility to improve overall sanitary and hygiene awareness, worldwide as required. This research paves a new way for good hygiene practices for mankind to fight against coronavirus as well as any future pandemic.

7 Declarations

7.1 Acknowledgement

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7.2 Competing Interests

The Authors declared that there is no conflict of interest exist in this publication.

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